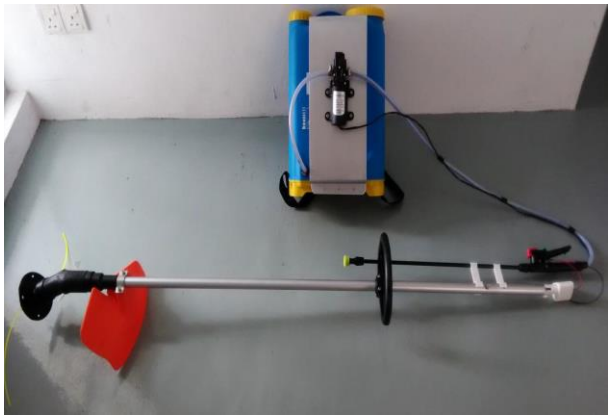
Engineering & Technology

2 IN 1 MULTIPURPOSE TOOLS FOR AGRICULTURAL USE

Researchers: *Nur Tahirah binti Razali, Al Maalik Faizal Bin Shaik Anwar Raja, Abang Mohammad Nizam bin Abang Kamaruddin, Ervina bt Junaidi and Marini Binti Sawawi*

Faculty of Engineering, Universiti Malaysia Sarawak

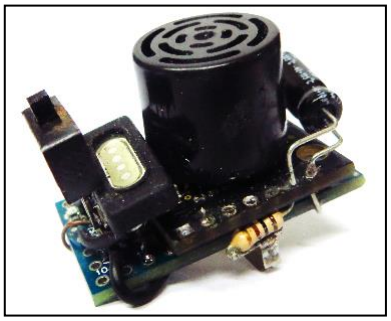
The site visit to Kampung Sungai Batu, Santubong allowed us to identify the problems faced by the farmers when maintaining their lawns. The main problem of the farmers are related to spraying pesticide on the weeds as well as cutting unwanted grass and shrubs. In order to solve the problems faced by the farmers, a 2-in-1 Multipurpose Tool which has the function of both pesticide sprayer and grass cutter machine is designed and fabricated.



A FINGER-BASED OBSTACLE DETECTOR FOR PEOPLE WITH LOW VISION

Researchers: *Lau Bee Theng and Derrick Ling Kuo Xiong*

Swinburne University of Technology Sarawak Campus



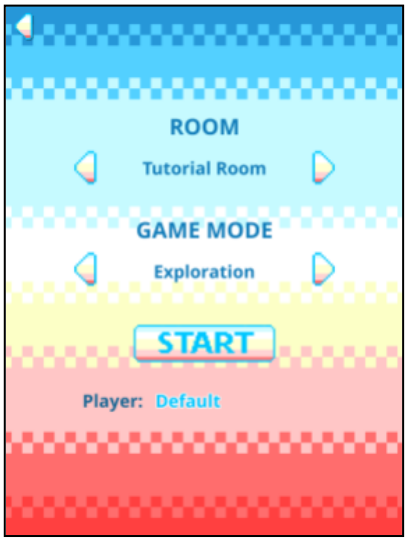
Visual impairment is the functional limitation of the eyes that may cause difficulties in performing normal daily activities such as walking. People with low vision have limited mobility as they have limited vision to move safely without colliding against obstacles. There are many research on developing obstacle detector for the visually impaired. However, there is still a lack of good obstacle detectors for people with visual impairment because most existing prototypes are in experimental stage without evaluation for their performance and usability. Some of the existing obstacle detectors have issues like bulky in size, heavy to carry on continuously, obstructive, high cost, and/or high maintenance. As a result of analysing the research problems, this research proposes a low cost, low computational power, small and compact, lightweight, non-obstructive and non-vision based obstacle detection model for the visually impaired. The prototype is built with an ultrasonic sensor to obtain real time information of distance between sensor and obstacles. This information is processed using a distance measurement algorithm and translated into an audio feedback which will alert a user of the presence of obstacles in the path. The prototype is small, compact and lightweight so it can be worn on the finger. Thus, it is flexible to allow the user changing the direction of the detection by

pointing. Three experimental testing were conducted to evaluate the prototype. First laboratory experiment was to determine the detection rate on indoor and outdoor obstacles of different sizes and shapes in a controlled environment. Second laboratory experiment was to test the prototype with participants wearing blindfolds (no vision simulator) and walking in the laboratory filled with real life obstacles. Third experiment was conducted with participants wearing low vision simulators walking in an uncontrolled outdoor environment. The results showed the prototype work well for people with low vision in an uncontrolled outdoor environment.

A GAME-BASED SPATIAL NAVIGATION LEARNING TOOL FOR CHILDREN WITH VISUAL IMPAIRMENT

Researchers: *Lau Bee Theng, Carmen Chai Wang Er and Derrick Ling Kuo Xiong*

Swinburne University of Technology Sarawak Campus

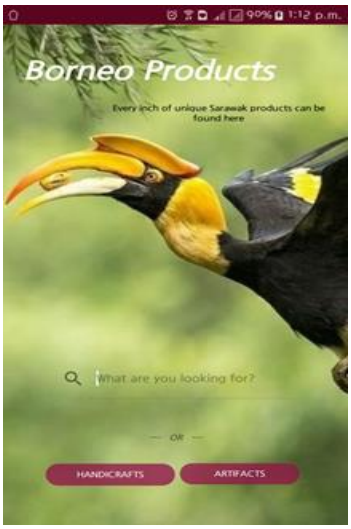


Although spatial navigation plays an important role in day to day life, there is a lack of tools, especially in the form of digital games which are able to aid visually impaired children in this aspect. The majority of tools and research developed with the purpose of conveying spatial information to the visually impaired are too complex and difficult for children as they are developed for adults. Many of these spatial navigation tools also lack portability as they are computer-based and use special equipment. This makes most of the existing tools difficult and expensive to set up for general use. The aim of this research is to address these issues by developing a serious spatial navigation mobile game for visually impaired children which is engaging and interactive. The game is developed for use on an Android device and is portable and requires no difficult setup to use. The prototype developed is called Hungry Cat and allows players to take the role of a cat which has been left at home and wants to find food. Through the game, the players will be able to navigate around various levels featuring rooms of a house to find food. This game was tested with 30 visually impaired children consisting of 17 with low vision and 13 with no vision, to evaluate its success in conveying spatial information. The game is evaluated through two tests, a food finding test and a wire net test. Food finding test is a game mode which finds out how quickly the players are able to locate a food item within the room that they have just explored. The wire net test on the other hand, allows the player demonstrate his/her spatial mental map of the explored room, by pointing out the placement and size of each item that he/she found in the room. The evaluation results from the two tests showed that the mobile game was indeed able to convey spatial information through the exploration of a virtual environment and the users can learn in a fun and interactive way.

A LOCATION-BASED PRODUCTS INFORMATION SYSTEM FOR BORNEO COMMUNITIES

Researchers: *Akeem Olowolayemo, Amalia bt Madihie and Diyana Roslan*

Faculty of Cognitive Sciences and Human Development, Universiti Malaysia Sarawak



Most remote communities still have economic and social challenges such as poverty, poor health, lower level of literacy and environmental issues. There is the need to explore emerging technologies and options toward measures that offer people direct economic and social benefits, including job opportunities, improved transportation, communication and housing, and better health and educational services. One of the ways to achieve the above lofty goals will necessarily include the use information systems for communities' information and communication. Specifically, there is the need to provide communities mapped information such as people, cultural heritage, products & artifacts, as well as peculiar delicacies to facilitate improved influx of people (consumers/tourists) to the communities which should in turns lead to direct economic and social benefits to the communities. Another direct usefulness of such system is the opportunity for government & policy makers to have immediate information on the communities and probably able to measure intervention impacts better. The first stage of this research is focused on developing information systems for products sold in the Borneo community that may be of interests to Tourists and other customers. The systems should be able to map different locations in the Borneo communities with differents products availlable in such locations.

A MINIMUM QUANTITY LUBRICATION APPLICATOR FOR LOW COST MILLING APPLICATION

Researchers: *Abang Mohammad Nizam bin Abang Kamaruddin and Abdullah bin Hj Yassin*

Faculty of Engineering, Universiti Malaysia Sarawak

The use of cutting fluid increases the rate of the manufacturing process but also cause increases its manufacturing cost. Cutting fluid also reduces health quality and the surrounding environment. To overcome this problem a new method of minimally used of cutting fluid is introduced. This method is known as Minimum Quantity Lubrication (MQL). The applicator designed have been found to significantly reduced the cutting force of dry cutting with

indication that the tool experienced the similar value of force with tools used in wet cutting. Meanwhile the tool wear is shown to be similar also to wet cutting. The use of palm oil as the lubrication oil also heighten the prospect of low running cost of the applicator. It is hope that the local small medium enterprises working on automotive sector will benefit through the introduction of this applicator in their machining processes

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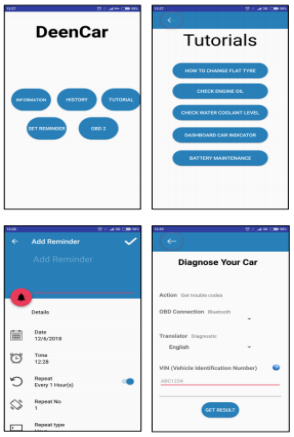
A MOBILE APPLICATION FOR CAR MAINTENANCE

Researchers: *Emmy Dahliana Binti Hossain and Muhamad Wazir Zainudin*

Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak



DeenCar is an Android application that provides related information for car maintenance, aimed at first time car owners or those with minimal or beginner level knowledge on car maintenance. The application is integrated with an On-Board Diagnostic (OBD) adapter that enables the information on the car's system to be displayed. Other features include reminder for car service and road tax renewal, basic car maintenance tutorials, and history of car services and road tax expiry dates. DeenCar hopes to help car owners take better care of their vehicle by providing the information to make better decisions and to monitor and maintain the "health" of their vehicle.

A SIMPLE METHOD FOR PALM OIL MILL EFFLUENT TREATMENT

Researchers: *Cirilo Nolasco Hipolito[1], Octavio Carvajal-Zarrabal[2], Hamady Dieng[3] and Kopli bin Bujang[4]*

[1]Faculty of Engineering, Universiti Malaysia Sarawak
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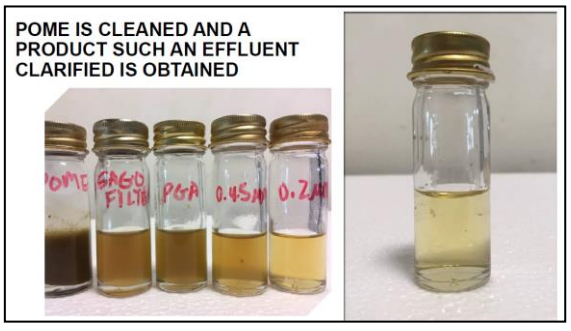

Palm oil mill effluent (POME) is a wastewater generated from palm oil milling activities which requires effective treatment before discharge into watercourses due to its highly polluting properties. However, this task still is not covered in any existing plant. The composition of the POME determine the essential step in the design of any wastewater treatment plant (WWTP) in the industry as conducting pilot-scale tests to obtain design and operating parameters is time-consuming and expensive. POME had been characterized mostly regarding to parameters listed as discharge standards by local environmental authorities and those that were

significant to the results of the chosen treatment methods. These parameters are very important in determining the suitable treatment method for industrial-scale WWTP designs besides detecting the operational problems of the selected treatment system due to the characteristics of POME. This would also ensure a proper process design and equipment sizing for POME treatment systems. Therefore, a comprehensive POME characterization is important, but the starting point is to remove the total solids then the next operation is to choose the most suitable method to reduce the other contaminants. This invention deal with a simple physical method to remove the solids contained in POME and then apply the necessary methods to remove the remaining contaminants

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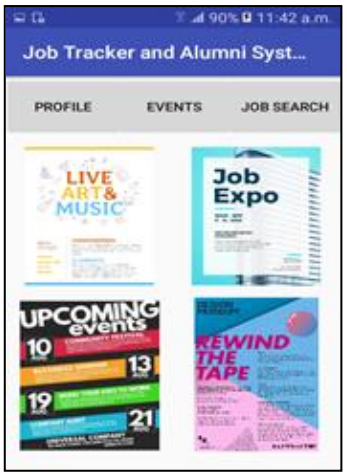
ALUMNI SYSTEM & UNIVERSITY BASED JOB RECOMMENDER

Researchers: *Akeem Olowolayemo and Kamaleiah binti Harun*

Faculty of Cognitive Sciences and Human Development, Universiti Malaysia Sarawak

The exponential growth of job Websites and increase in the number of job information that is available online creates a daunting task in information management for job seekers. There is a need to therefore filter job information from available job Websites and social media networks, and generate personalized job information based on users' profile. In the proposed architecture, user profile will be extracted from social networks and job information from job Websites. After the extraction process, baseline term based similarity will be used to match user profile with the job information to recommend job information for each of the user.



AREFCERT: RADIOFREQUENCY (RF) RADIATION SAFETY LEVEL SYSTEM

Researchers: *Roha Tukimin, Mohd Dzul Aiman Bin Aslan, Shamesh Raj Parthasarathy and Rasif Mohd Zin*

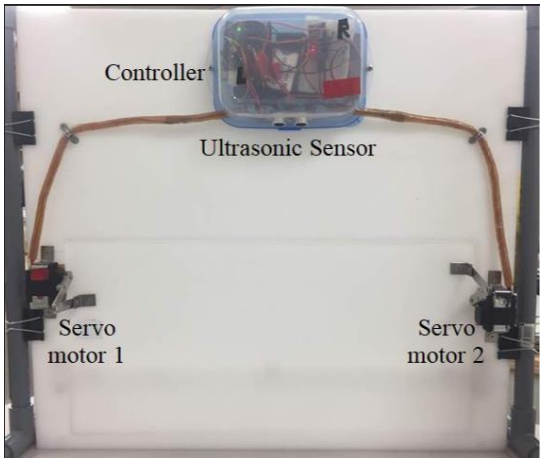
Agensi Nuklear Malaysia

The objective of the project is to establish a system for radio frequency (RF) radiation safety level in Malaysia. The AREFCERT system is developed using framework using PHP, Javascript, MySQL and integrated with Google Map. The system is the only portal in Malaysia which provide information on radio frequency radiation level emitted by telecommunication structure and is accessible by public. It will feature the location of towers, date of reading, the reading indicator and status of RF radiation compliance with the permissible exposure limit.

AUTOMATIC CONTROL SYSTEM FOR FLOW REGULATOR GATE IN DRAINAGE SYSTEM

Researchers: *Charles Bong Hin Joo[1], Leong Geok Teng[1], Akihiko Hanafusa[2], Aminuddin Ab. Ghani[3] and Lau Tze Liang[3]*

[1]Faculty of Engineering, Universiti Malaysia Sarawak
[2]Shibaura Institute of Technology
[3]Universiti Sains Malaysia

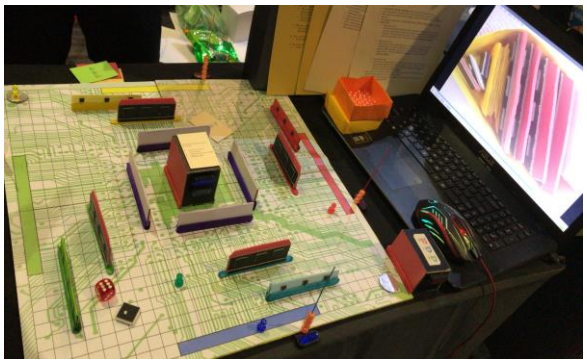


Higher surface runoffs, the accumulation of deposit and debris in drain have an impact on the drainage system performance in term of higher risk of local flooding during intense rain events. In Malaysia, the local council has spends a lot of money on drain-widening projects and drain maintenance to resolve the flood problems. Thus, flow regulator gate is proposed as an alternative solution in drainage management. The flow regulator gate is developed based on the concept of hydraulic flushing gate, combined with automated control system. The system consists of an ultrasonic sensor, two servo motors, real time clock (RTC) module and microcontroller. The water level in the drain is used to activate the release and closure of the gate using water level sensor that attached on the controller. In addition, activation by real time clock is set to allow flow, noting when the water level is not enough at certain time frame, especially during dry season. There are two functions of the flow regulator gate. Firstly, it acts as a control structure to control the flow of water for urban stormwater system. The gate can be installed at the drainage section to reduce peak flow caused by urban runoff. This action will retain heavy runoff during raining event and allow drain with lower runoff to convey first at the drain connecting point. The aim is to reduce water congestion at the bottleneck at the drain, thus reducing the chances of overflow of water. Secondly, the device also contributes to drain cleaning due to the operational mechanism of the flushing gate. When water level reaches a predetermined level, thereby releasing the gate and causing “dambreak” flushing wave occur. This high velocity of the flush wave is effective in scouring and transporting the particles deposited on the bottom of drain channels.

BATTLE OF DATA

Researchers: *Norhaida Binti Hussain, Freddie Allance Anak Ujan, Kevin Ravenelli Anak Tanggi, Elijah Avit Anyi and Suharmin Bin Asiman*

Politeknik Kuching Sarawak



Traditional learning styles such as lectures supported by few teaching tools such as Power Point and video are common in schools, polytechnics and university. Students learning experience is important to help them understand the concept of difficult topic easily. Very often, students will get bored when listening to lectures. In consequence, students could not masters the course and they could face more problems when they enrol in the higher level course for the next semester. Moreover, competitive sprite between students would increase their revision time in order to win the game. The learning style through game have positive impact on students as they are more engaged in learning process (Kirkland et al, 2008). Furthermore, learning through games is effective, enjoyable and suitable for all ages. The objectives of B.O.D game board is: 1- To design a fun learning experience for students, 2- To promote learning for course Computer System Architecture (CSA) and 3-To increase students' performance in classroom. The designing of B.O.D game board is inspired by the structural design of a motherboard. The first stage is designing the game concept which include "how to start the game and to win the game". To realize the game concept, game rules are designed. The second stage is designing game components such as Characters, Dice, Miniatures and Cards. The third stage is designing the questions and answers. The fourth stage is assembling components and board. The last stage is testing the game. We tested the game board to ensure it could be played according to game rules and someone could win the game. We believed that learning CSA through game could enhance students' understanding and increase their performance in class. In conclusion, increased students understanding in CSA course would improve their performance during Final Test.

COMPRESSIVE STRENGTH DEVELOPMENT FOR MODIFIED PEAT USING RUBBER CRUMB (RC) AS REINFORCEMENT WITH ELECTROKINETIC TREATMENT (EKT)

Researchers: *Norazzlina bt M. Sa'don, Abdul Razak bin Abdul Karim, Emilia Evyln Christermaller, Mohamad Hanif bin Mohamad Ariffin and Albert Akun Merang*

Faculty of Engineering, Universiti Malaysia Sarawak

Peat consists of the highly organic substance that derived primarily from plant material which is form when decomposed plant/animals accumulate more quickly than it humidifies. Peat possesses low strength, low bearing capacity and easily undergo differential and total settlement and recorded the highest moisture content (200-2200%) among all the soils. Therefore, it is crucial to enhance stability, increase bearing

capacity, and reduce excessive settlement as well as lateral deformation to support and improve any structure and/or infrastructure build on peat. This study focused on investigating the strength increment of peat in natural and dry state mixed as sub-grade layer with various percentages (0.3%, 0.5%, and 0.8%) of nylon fiber (NF) as reinforcement, 5% cement as binder and later the treated peat were applied to the electrokinetic treatment (EKT) for further enhancing the compressive strength. The nylon fiber is chosen due to its very strong characteristic with extremely resistant to abrasion and bending. It is lightweight with the specific gravity of 1.04 and durability properties make nylon fiber an ideal reinforcement material. The nylon fiber varies from 10 mm to 50 mm length sizes and is a product from the tire waste disposal (extracted from car type). The peat samples collected are categorized as Sapric peat (H7) with recorded moisture content of 425%. The development of the compressive strength was determined by using Unconsolidated-Undrained (UU) Triaxial test for natural state, Unconfined Compressive Strength (UCS) test and California Bearing Ratio (CBR) test are at drying state. All samples were air-cured for 7 days, 14 days and 28 days. The application of EKT was practiced with 3.0 V and 12 V applied for 10 minutes duration for UU/UCS and CBR, respectively. From the preliminary results obtained (Figure 1), the treated peat using nylon fiber and electro-kinetic treatment has improved significantly the compressive strength of the treated peat for both natural and dry state when compared to non-treated peat.

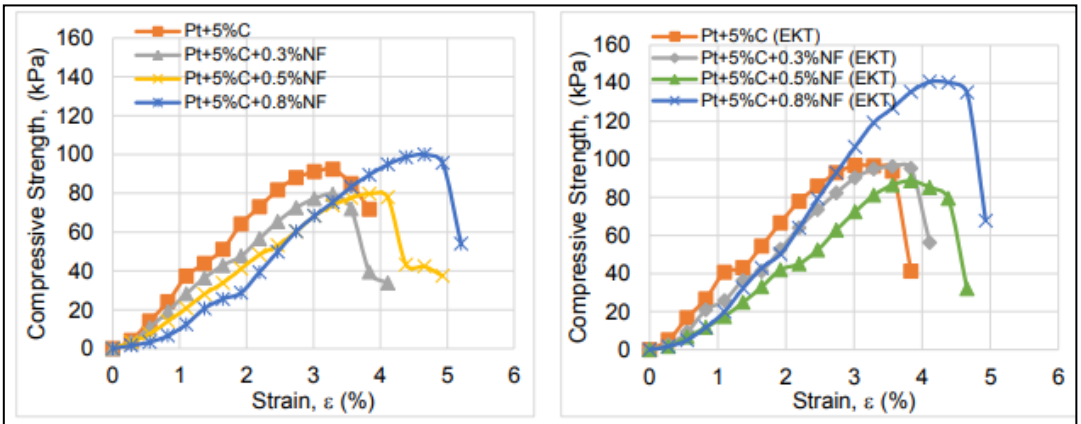


Figure 1 Comparison of EKT for Reinforced Peat with Nylon Fiber (NF)

DESIGN AND APPLICATION OF PROTO-SCALE SUBMERGED MECHANICAL AERATOR TO CIRCULATE AND OXYGENATE THE HYPOLIMNETIC LAYER OF RESERVOIRS ACROSS SARAWAK.

Researchers: *Khairuddin Sanaullah, Andrew Ragai Henry Rigit, Harunal Rejan bin Ramji and Muhammad Umar Mushtaq*

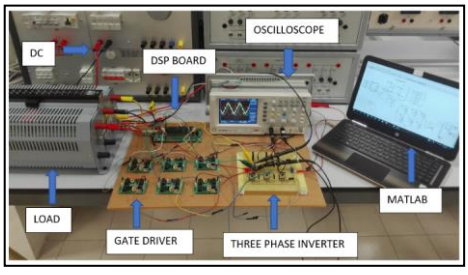
Faculty of Engineering, Universiti Malaysia Sarawak

Due to deficient oxygen level at the bottom of thermal stratified lakes, the reduction reactions occur that form hydrogen sulphide , iron and other organic compounds which are harmful for the water quality, fish life as well as reservoir structures. Conventional methods such as airlift aeration and bubble plume diffusors are used but they require huge compressors and less ability to enrich the water with oxygen. The purpose of this research to push the excessive layer of oxygen to the bottom layer of the lakes and reservoirs by using prototype submerged mechanical aerator (PSMA).

DESIGN AND IMPLEMENTATION OF SPACE VECTOR PULSE WIDTH MODULATION (SVPWM) FOR HARMONIC REDUCTION FOR THREE PHASE INVERTER SYSTEM

Researcher: *Yonis. M.Yonis Buswig*

Faculty of Engineering, Universiti Malaysia Sarawak

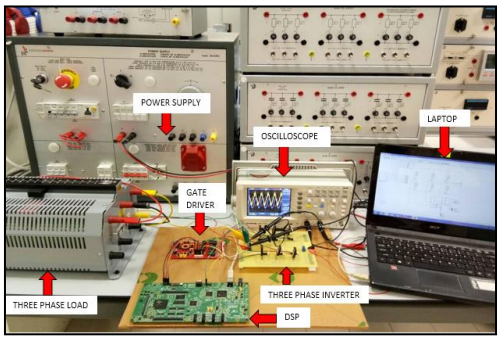


Alternating current (AC) and direct current (DC) are biggest part in electrical world. Everything is empowered by either AC or DC as the source. When AC and DC are needed in one system, conversion technique is used in between them for a particular system to work. Conversion of DC to AC needs inverter while AC to DC is rectifier. In this project, issue will be focused on inverter, specifically three phase inverter. Problem started to arise when total harmonic distortion is higher during the conversion. Changing DC to AC gives more noise at the output. This noise or distortion can bring many problems to the equipment that being supplied. It can shorten the lifespan of an equipment. This report presents a simulation and development of three phase inverter by using space vector pulse width modulation (SVPWM) as control system to reduce harmonics. The model was implemented using MATLAB/Simulink with the block set and also M-file. Metal-Oxide-Semiconductor-Field-Effect-Transistor (MOSFET) was used as switches. In three phase inverter, a Direct Current (DC) source is supply and converted to Alternating Current (AC) by switching the switches on each leg to ON and OFF state based on the control system. The SVPWM is used as the control system to control the switching scheme of the MOSFET in this project.

DEVELOPMENT AND MODELING OF THREE PHASE INVERTER FOR HARMONIC IMPROVEMENT USING SINUSOIDAL PULSE WIDTH MODULATION (SPWM) CONTROL TECHNIQUE

Researcher: *Yonis. M.Yonis Buswig*

Faculty of Engineering, Universiti Malaysia Sarawak



This project concentrates on development and modeling of three phase inverter for harmonic improvement using Sinusoidal Pulse Width Modulation (SPWM) Control Technique. The inverter converts electrical signal from Direct Current (DC) to Alternating Current (AC). An internal control technique of an inverter is Pulse Width Modulation (PWM) technique. The Sinusoidal Pulse Width Modulation (SPWM) technique is a type of the PWM that is used in this project to control the output of the inverter. Today, harmonics has become the common problem because there are many modern electronics equipment. The incidence of harmonic related problems in power system distribution is high, so awareness of harmonic issue can help to increase plant power reliability. The objectives of this project are to model and simulate the three phase inverter system with a suitable topology using the MATLAB Simulink software, to develop a control strategy of the three phase inverter circuit, to design and demonstrate the laboratory prototype for three phase inverter and last but not least to analyze the total harmonic distortion (THD) for the three-phase inverter using the proposal SPWM control. The development and modeling of three phase inverter for harmonic improvement by using the SPWM control technique is implemented in the software and hardware parameters. The software that is used in the project is MATLAB Simulink. The hardware that are used in the project are Digital Signal Processors (DSPs), Printed Circuit Board (PCB), Gate Driver Circuit and Insulated Gate Bipolar Transistor (IGBTs) switches. A perfect sine wave and smooth supply are obtained from the inverter using the SPWM technique. The minimum of harmonic incidence are obtained from the project outcomes. Hence, the SPWM technique improved the performance of equipment and the power quality.

DEVELOPMENT OF TWO-PORT NETWORK ANALYZER FOR MICROWAVE MEASUREMENT COVERING FROM 100 MHZ TO 2.7 GHZ

Researchers: Then Yi Lung, Su Hieng Tiong and Chamath Kalanaka Vithanawasam

Swinburne University of Technology

Vector network analyzers (VNAs) are frequently used in radio frequency (RF) and microwave measurements. Given their high cost, bulkiness, and instrument complexity, development of cost-efficient and compact VNAs is essential. In this context, we developed a low-cost two-port VNA with reasonable frequency range in the S-band. The device was comprised of Raspberry Pi 3 model B, AD8302 RF/IF gain and phase detector, and the SynthHD microwave frequency synthesizer. Raspberry Pi microcomputer was connected to a screen to display the S-parameters. Graphical interface user (GUI) was designed to collect and analyze the data obtained from the VNA. Moreover, calibration was performed on the VNA to ensure accurate readings. We also evaluated the feasibility and practicality of this low-cost VNA for measuring RF and microwave.

DIELECTRIC MATERIALS PRODUCTION FROM BORNEO ACACIS`S WOOD REINFORCED GREEN COMPOSITES

Researchers: *Elammaran Jayamani, Muhammad Khusairy Bin Bakri and Akshay Kakar*

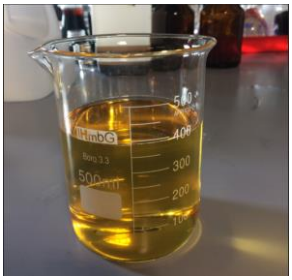
Swinburne University of Technology Sarawak Campus

Acacia's wood fibers as the reinforcement component in polymers to add specific properties in the final product to create bio-composites. Increasing awareness towards sustainable product design and the rising trends in its demand, wood fiber materials are gaining popularity to replace synthetic fiber in the fabrication of composites. Traditionally dielectric materials are made from inorganic substances, such as mica and silicon dioxide. Inorganic materials have higher thermal properties. Polymers are gaining wider use as dielectric materials due to easier processing, flexibility, able to tailor made for specific uses. The coefficient of thermal expansion is relatively larger than ceramic materials. It has weak mechanical strength. Acacia's wood fiber reinforced polymer bio-composites (synergism properties).

DIESEL ADDITIVE FROM BIODIESEL

Researchers: *Tay Meng Guan[1], Mohd. Azizul Hafiz bin Jamian[2] and Hansel Dina Bin John[1]*

[1]Faculty of Resource Science and Technology, [2]Faculty of Social Sciences and Humanities, Universiti Malaysia Sarawak

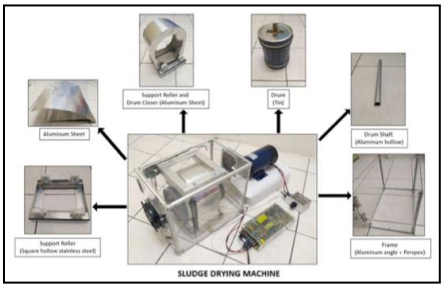


The project developed an additive specifically for current diesel engine in order to enhance the performance of the engine by cleaning the common rail and unit injection systems. By employing the additive, the combustion performance of the diesel engine was increased by measuring the reduction of carbon monoxide and residual hydrocarbon emission (at 1200 rpm compared to ordinary diesel).

DRYING MACHINE FOR SUSPENDED SOLID (PALM OIL MILL SLUDGE)

Researchers: *Abdullah bin Hj Yassin, Abang Mohammad Nizam bin Abang Kamaruddin, Mohd Helmi Bin Rashid and Shahrol bin Mohamaddan*

Faculty of Engineering, Universiti Malaysia Sarawak



Palm Oil Mill Sludge (POMS) has numerous elements of nutrient such as Phosphorus and Nitrogen. Because of the present of these nutrients, the sludge can be cultivated as fertilizer if the moisture content is lowered to certain percentage. Based on the previous research, the most suitable moisture content of sludge for composting purpose is around 50 % to 60 %. In order to lower the moisture content, the sludge must undergo the drying process. The current practice by the POM at Serian, the workers use the conventional way which is disposing the sludge into the pond to be dried under the sunlight. However, this conventional way has limitation where it only depends on the weather. In order to solve this problem, the drying machine has been designed. The invention of this drying machine is based on the scientific knowledge and the use of technology. The recent product of the sludge drying machine is known as decanter cake machine. Based on the scientific knowledge there are many ways to reduce the water content inside the sludge for example by using the centrifugation or even by the combination of centrifugation and hot air. Thus, this project design and fabricate a sludge drying machine. It is invented to dry the sludge by reducing its water content. The machine is operated based on the application of centrifugation and forced air convection. The dimension of the machine is 20cm x 30cm x 24cm and has the weight of 6kg. Maximum weight of sludge that can be dried by the machine is up to 3kg. The machine is equipped with electronics components such as exhaust fan, temperature controller and heating element. These components are responsible to provide the dry air inside the machine. With the invention of sludge drying machine, the sludge can be dried in a shorter time and a drying process can be done at any time without depending on weather condition.

E-LAB KEY MANAGEMENT SYSTEM

Researchers: *Ng Boon Ding, Cyril Balan Paran, Jesica Emlyne Anak Minggat and Brooklyn Anak Jafar*

Politeknik Kuching Sarawak

"E-Lab Key Management System" is systems that help to secure the key and record the data of the key user. This system records the name of the lecturer who holds the key. There are three objectives that to achieve, first is to identify the person who holds the key for Department of Technology Information and Communication in Polytechnic Kuching Sarawak. Second objective is to build up a secure place to store the key by using this system. The last objective is to generate key usage log report for audit purpose. The methodology that have been use to develop this system is Rapid-application Development Model. The model is a step-by-step sequential execution of each phase of the software life cycle. In addition, this system was developing using XAMPP to create a local web server for testing and deployment purposes and PHP as a programming language support. Based on information obtained, it is known that the Department of Technology Information and Communication in Polytechnic Kuching Sarawak does not have a system to record the person who holds the key when they using the key. It is difficult for the administrator to record the data of the usage of the key. Hence, this system can make the job of the administrator become easier.

ELECTROKINETIC TREATMENT (EKT) ON REINFORCED PEAT WITH NYLON FIBER FOR THE SUB-GRADE LAYER STRENGTHENING

Researchers: *Norazzlina bt M. Sa'don, Abdul Razak bin Abdul Karim, Emilia Evyln Christermaller, Mohamad Hanif bin Mohamad Ariffin and Albert Akun Merang*

Faculty of Engineering, Universiti Malaysia Sarawak

Peat consists of the highly organic substance that derived primarily from plant material which is form when decomposed plant/animals accumulate more quickly than it humidifies. Peat possesses low strength, low bearing capacity and easily undergo differential and total settlement and recorded the highest moisture content (200-2200%) among all the soils. Therefore, it is crucial to enhance stability, increase bearing capacity, and reduce excessive settlement as well as lateral deformation to support and improve any structure and/or infrastructure build on peat. This study focused on investigating the strength increment of peat in natural and dry state mixed as sub-grade layer with various percentages (0.3%, 0.5%, and 0.8%) of nylon fiber (NF) as reinforcement, 5% cement as binder and later the treated peat were applied to the electrokinetic treatment (EKT) for further enhancing the compressive strength. The nylon fiber is chosen due to its very strong characteristic with extremely resistant to abrasion and bending. It is lightweight with the specific gravity of 1.04 and durability properties make nylon fiber an ideal reinforcement material. The nylon fiber varies from 10 mm to 50 mm length sizes and is a product from the tire waste disposal (extracted from car type). The peat samples collected are

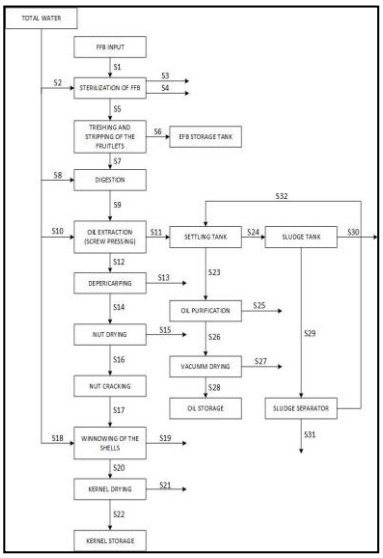
categorized as Sapric peat (H7) with recorded moisture content of 425%. The development of the compressive strength was determined by using Unconsolidated-Undrained (UU) Triaxial test for natural state, Unconfined Compressive Strength (UCS) test and California Bearing Ratio (CBR) test are at drying state. All samples were air-cured for 7 days, 14 days and 28 days. The application of EKT was practiced with 3.0 V and 12 V applied for 10 minutes duration for UU/UCS and CBR, respectively. From the preliminary results obtained (Figure 1), the treated peat using nylon fiber and electro-kinetic treatment has improved significantly the compressive strength of the treated peat for both natural and dry state when compared to non-treated peat.

ENERGY PINCH ANALYSIS OF PALM OIL MILL

Researchers: *Norlisa binti Mili, Rubiyah bt Hj Baini, Shanti Faridah binti Salleh, Shammini M. Doraisamy and Dayang Ajeerah Abang Husaini*

Faculty of Engineering, Universiti Malaysia Sarawak

Since it is well known that energy wastage would lead to loss of profit, this research is conducted to reduce and conserve the energy consumption at its optimal level. In order to achieve the major aim of this research, three objectives are drawn as an aiding guideline to be achieved throughout the project. Upon the progress of achieving the objectives of this research, Microsoft Excel was used to develop the mass and energy balance of the overall palm oil mill and Optimal Heat software was used to perform energy pinch analysis as well as to develop heat exchanger network diagrams for each possible case of pinch analysis. The major reason for this approach to be chosen is that, heat exchanger network design is the very direct optimization method which had been adapted from pinch analysis itself.

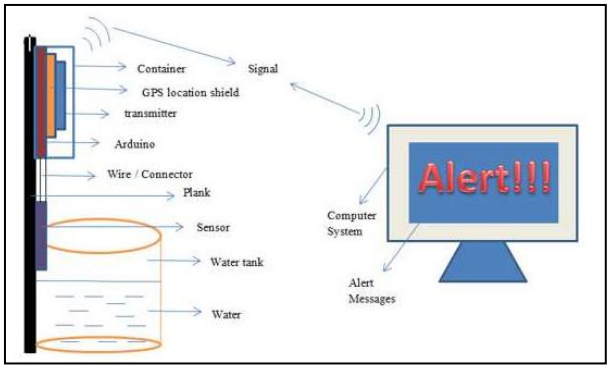


FLASH FLOOD DETECTION USING STREET LAMP POST

Researcher: *Chai Soo See*

Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak

This project intends to demonstrate the use of street lamp post installed with Arduino water level sensor for flash flood detection. The prototype also included a web-based monitoring system and SMS warning system. The spatial and temporal resolution for flash flood detection will be greatly improved by utilizing the street lamp post.



FLOOD PREDICTION USING DEEP LEARNING

Researcher: *Abdulrazak Yahya Saleh Al-Hababi*

Faculty of Cognitive Sciences and Human Development, Universiti Malaysia Sarawak

Flood is one of the natural calamities that Malaysia faces almost every year in varying degree of magnitude. Throughout Malaysia, including Sabah and Sarawak, an estimated of 9% total area of Malaysia is vulnerable to flood and approximately almost 4.82 million people are affected by flood (DID, 2009). To address such challenge, this study proposed a flood forecasting modelling system that models the water-level evolution based on deep learning approach using the Long Short Term Memory (LSTM). This research focuses on flood prediction in the region of Bedup River, Serian, Sarawak using seven data sets obtained from Irrigation and Drainage Department (DID) with the year range 2014 to 2017.

GREEN WALL AS AN URBAN HEAT ISLAND (UHI) MITIGATION STRATEGY

Researchers: *Nurul Izzati binti Ahmat @ Ibrahim, Siti Halipah bt Ibrahim, Julaihi bin Wahid, Dona Rose Koesmeri and Bambang Karsono*

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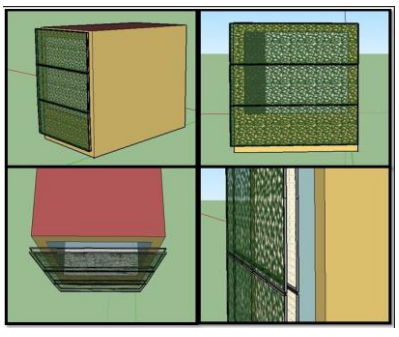

Rapid urbanization and development of cities all around the world have triggered many environmental issues. This extreme and unplanned growth of urbanization has triggered undesired side effects around the world. One of the major side effects is the development of urban heat island (UHI) phenomenon. UHI is a climatic phenomenon caused by the modification of the climate, due to the changes made in the form and composition of the land surface and atmosphere. UHI is common in urban and suburban areas due to the concentrations of structures and pavement areas. The structures are typically constructed using the material such as

concrete that can retain and absorb a high amount of heat from the sun than the natural materials utilized in rural areas. This study has focused on investigating the impact of vertical urban surfaces towards the development of UHI phenomenon. In order to determine the suitable solution to mitigate UHI phenomenon, an office room of Sarawak Energy Berhad (located in the suburban area) has been modelled using SketchUp and then simulated in terms of thermal performance by using EnergyPlus software. The input of the software is using the data collected from the internal and external of the office room. The selected office room has undergone retrofitting process using the most suitable approach to mitigate UHI. The approach suggested is to incorporate green wall to the office. The proof of the effectiveness of green wall is presented by comparing the air temperature, mean radiant temperature as well as the operative temperature of the retrofitted room with the original room. This research can provide sustainable building design guideline for local designers, decision-makers and urban planner. Additionally, this study can also help to increase the awareness on the importance of choosing appropriate construction materials, not only for their esthetical appeal but also considering their effect towards building energy consumption and local climate.

HILICOP-HIGH PERFORMANCE PRECAST CONSTRUCTION PRODUCTS

Researchers: *Mohammad Abdul Mannan, Lee Shyue Leong, Chia Chuong Yan, Kang Wei Jun, Lau Zong Ying, Law Hui Soon and Leong Kah Seng*

Faculty of Engineering, Universiti Malaysia Sarawak

HiLiCop is polymer based lightweight concrete made using solid wastes with fabric-reinforced. It is high performance precast product suitable for the construction and furniture industries. The main features are fast hardening, high mechanical properties and chemical resistance. Different products such as: 1). HiLiCop Sandwich-wall panel being lightweight is suitable for both external and internal non-load bearing wall. 2). HiLiCop High-density plank as alternative to conventional planks (solid timber, plywood and particle board) is suitable for heavy duty laboratory table, rigid-subbase in pavement, slope surface protection etc. 3). HiLiCop Handrail being lightweight is alternative to conventional metal handrail useful as noncorrosive and anti-theft product.

Figure 1: HiLiCop-High Density Plank

Figure 2: HiLiCop-Handrail

Figure 3: HiLiCop-Handrail

Figure 4: HiLiCop-Sandwich Wall Panel